

WHAT IS CLAIMED IS:

1. A synthetic focus ultrasound system comprising:

- 5 an array of transducer elements;
 a transmitter coupled to the transducer which acts to produce, in a first mode, transmit events by the transmission from an individual element or group of elements over the full image field, and in a
10 second mode, to produce focused transmit beams from a plurality of transducer elements;
 a receiver coupled to the transducer which receives echo signals from elements of the array in response to a transmit event or a focused transmit
15 beam;
 a processor coupled to the receiver which selectively performs synthetic focusing of signals received in response to transmit events or focused receive beams in response to focused transmit beams;
20 and
 a display which displays images produced from synthetically focused and focused beam transmit signals.

25 2. The synthetic focus ultrasound system of Claim 1, wherein the echo signals received from elements of the array in response to a transmit event comprise linear signals, and wherein the echo signals received in response to a focused transmit beam
30 comprise nonlinear signals.

3. The synthetic focus ultrasound system of Claim 2, wherein the linear signals comprise
35 fundamental frequency signals, and wherein the nonlinear signals comprise harmonic frequency

signals.

4. The synthetic focus ultrasound system of Claim 1, wherein the processor produces motion
5 depicting signals through synthetic focusing, and tissue depicting signals through the focusing of echo signals received in response to a focused transmit beam.

10 5. The synthetic focus ultrasound system of Claim 4, wherein the motion depicting signals and the tissue depicting signals are used in a displayed color flow image.

15 6. The synthetic focus ultrasound system of Claim 5, wherein the echo signals received in response to a transmit event are at a fundamental frequency and wherein the echo signals received in response to a focused transmit beam are at a harmonic
20 frequency.

7. A synthetic focus ultrasound system comprising:
an array of transducer elements comprising a
25 plurality of sub-apertures;
a transmitter coupled to the transducer which acts to produce transmit events by the transmission from an individual element or group of elements over the full image field;
30 a receiver coupled to the transducer which receives echo signals from elements of the array in response to a transmit event or a focused transmit beam;
a processor coupled to the receiver which acts
35 to process different image data sets from different

sub-apertures of the transducer array

a combiner which acts to combine image data from the different sub-apertures; and

5 a display which displays images produced from the combined image data,

wherein image speckle is reduced by spatial compounding.

10 8. The synthetic focus ultrasound system of Claim 7, wherein the different sub-apertures view the image field of the transducer array from different look directions.

15 9. A synthetic focus ultrasound system for imaging an image field comprising:

an array of transducer elements;

20 a transmitter coupled to the transducer which acts to produce transmit events by the transmission from an individual element or group of elements over the full image field;

a receiver coupled to the transducer which receives echo signals from elements of the array in response to a transmit event;

25 a processor coupled to the receiver which performs synthetic focusing of a first type in a designated portion of the image field, and synthetic focusing of a second type in a surrounding portion of the image field; and

30 a display which displays an image including the designated portion of the image field.

35 10. The synthetic focus ultrasound system of Claim 9, wherein the designated portion of the image field comprises a region of interest delineated by a user.

11. The synthetic focus ultrasound system of
Claim 9, wherein the first type of synthetic focusing
comprises a first type of motion processing, and
5 wherein the second type of synthetic focusing
comprises a second type of motion processing.

12. The synthetic focus ultrasound system of
Claim 11, wherein the first type of motion processing
10 detects motion of a first velocity or velocity range
and wherein the second type of motion processing
detects motion of a second velocity or velocity
range.

13. The synthetic focus ultrasound system of
Claim 9, wherein the first type of synthetic focusing
comprises relatively high resolution focusing and
wherein the second type of synthetic focusing
comprises relatively low resolution focusing.

20